2015

a)

1- إثبات معادلة ال E و ال H

b-

$$E = E_o \cos(\omega t - \beta z)\, \hat{a}_y$$

$$\eta = \frac{E}{H}$$

$$H = \frac{E}{\eta} \qquad \eta = \sqrt{\frac{j\omega\mu}{\sigma + j\omega\epsilon}}$$

$$\eta = |\eta|\, e^{j\theta_\eta}$$

$$H = \frac{E_o}{|\eta|} \cos(\omega t - \beta z - \theta_\eta)$$

Direction of propagation in (z) direction

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2)

a- قوانين ال good conductor

$$E = E_o\, e^{-\sqrt{\frac{\omega\mu\sigma}{2}}\cdot z}\, e^{-j\sqrt{\frac{\omega\mu\sigma}{2}}\cdot z}\, e^{j\omega t}$$

$$H = \frac{E_o}{|\eta|}\, e^{-\sqrt{\frac{\omega\mu\sigma}{2}}\cdot z}\, e^{-j\sqrt{\frac{\omega\mu\sigma}{2}}\cdot z}\, e^{-j\theta_\eta}\, e^{j\omega t}.$$

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$E(y,t) = 8\times10^{-5}\ e^{-\alpha y}\ \cos(3\pi\times10^{6}t - \beta y)\ \hat{a}_x$

$\sigma = 7\times10^{-3}$ $\quad \epsilon_r = 4$

1- $\dfrac{\sigma}{\omega\epsilon} \cong 21 \gg 1$

Good Conductor

2. $\alpha = \sqrt{\dfrac{\omega\mu\sigma}{2}} = 131.6\sqrt{\mu}$ Np/m

$\beta = 131.6\sqrt{\mu}$ rad/m

3- $\eta = \sqrt{\dfrac{\omega\mu}{2\sigma}} + j\sqrt{\dfrac{\omega\mu}{2\sigma}}$

$\delta = \dfrac{1}{\alpha}$

$u = \dfrac{\omega}{\beta} = \dfrac{\omega}{\sqrt{\frac{\omega\mu\sigma}{2}}} = \sqrt{\dfrac{2\omega}{\mu\sigma}}$

3- Propagating in $(+y)$ direction

4- if $\omega = 3\pi\times10^{9}$

$\dfrac{\sigma}{\omega\epsilon} = .02 \ll 1$

The medium change its Response to dielectric medium

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1- is The direction of the electric field.

→ آلتب عادرت ٥ ال
linear
circular
elliptical

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b- $E(x,t) = 5\times 10^{-3}\, e^{-10x} \cos(5\pi\times 10^{9} t - 8\pi x)\,\hat{a}_y$

$+ E_0\, e^{-\alpha x} \cos(\omega t - \beta x + \theta_0)\,\hat{a}_z$

$\alpha \neq \beta \Rightarrow$ dielectric

for linear

i- $\theta = \tan^{-1}\left(\frac{E_{02}}{E_{01}}\right)$

$\underline{E_{02} = E_{01} \tan 30}$

$\theta_0 = 0$

ii- Circular

$\theta_0 = +90$ clock wise

-90 anti clock wise

$E_{01} = E_{02} = 5\times 10^{-3}$

iii- Elliptical

$\theta_0 = 90$ clock wise

-90 anti clock wise

$E_{01} \neq E_{02}$

lossless medium

اثباتات
ال (Γ و τ)
ال ~~بتوع~~ normal

$$\left(\eta_1 = \sqrt{\frac{\mu_1}{\epsilon_1}} \quad \eta_2 = \sqrt{\frac{\mu_2}{\epsilon_2}} \right)$$

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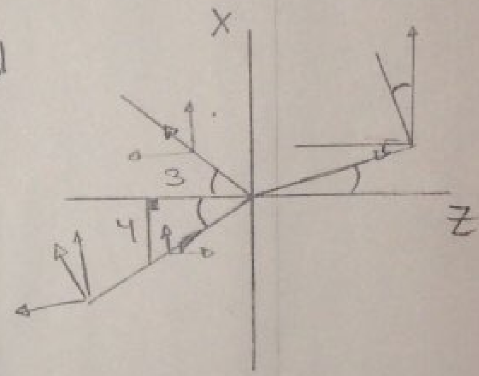
b) $E = .8 \cos(3\pi \times 10^7 t - 3x - 4z)\, \hat{a}_y$ v/m.



i- wave is perpendicular polarized

ii-
$$\theta_i = \tan^{-1}\left(\frac{4}{3}\right) = 53.13^\circ$$

$$\theta_i = \theta_r = 53.13^\circ$$

$$k_i \sin\theta_i = k_t \sin\theta_t$$

$$\sqrt{3^2+4^2}\, \sin(53.13) = .497 \sin\theta_t$$

$$\theta_t = -$$

$$|k_t| = \beta_2 = \omega\sqrt{\mu_0 \times 2.5\epsilon_0}$$
$$= .497$$

$$\eta_1 = 120\pi$$
$$\eta_2 = \sqrt{\frac{\mu_0}{2.5\epsilon_0}}$$

iii
$$\Gamma_\perp = \frac{\eta_2 \cos\theta_i - \eta_1 \cos\theta_t}{\eta_2 \cos\theta_i + \eta_1 \cos\theta_t}$$

$$\tau_\perp = \frac{2\eta_2 \cos\theta_i}{\eta_2 \cos\theta_i + \eta_1 \cos\theta_t}$$

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$= \Gamma_\perp \cdot E_i$

$= \Gamma_\perp * .8 \cos(3\pi\times10^7 t - 3x + 4z)\ \hat{a}_y$

$E_t = \tau_\perp * .8 \cos(3\pi\times10^7 t - \ x - \ z)\ \hat{a}_y$

$(k_t \cos\theta_t) z$
$(k_t \sin\theta_t) x$

$\cancel{H_t =}$ $\quad \eta_2 = \frac{E_t}{H_t}$

$H_t = \frac{E_t}{\eta_2}$

$= \left(\frac{\tau_\perp * .8}{\eta_2} \cos\theta_t\ \hat{a}_x \right.$

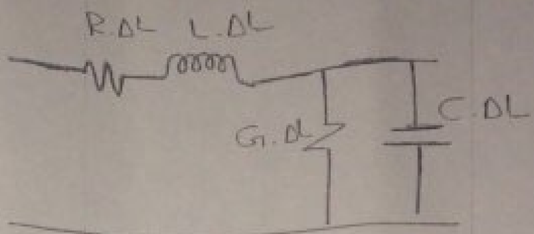
$\left. - \frac{\tau_\perp * .8}{\eta_2} \sin\theta_t\ \hat{a}_z \right) \cos(3\pi\times10^7 t - \ x - \ z)$

5) $\Gamma_1 = \Gamma_2$

$\cancel{\sin(\theta_{B\perp})} \ne$ $\theta_{B_\perp}$ is not exist

5)

a-



For distortionless line

$$\frac{R}{L} = \frac{G}{C}$$

b-

$Z_o = 75$ $\quad u = .6C$ $\quad \alpha = 20m$ $\quad F = 100M$

$$Z_o = \sqrt{\frac{L}{C}} = \sqrt{\frac{R}{G}} = 75$$

$$\alpha = \sqrt{RG} = 20 * 10^{-3}$$

$$RG = (20 * 10^{-3})^2$$

$$\frac{L}{C} = \frac{R}{G} = (75)^2$$

$$R = (75)^2 \cdot G$$

$$75^2 \cdot G \cdot G = (20 * 10^{-3})^2$$

$G =$ ✓

$R =$ ✓

$$\beta = \frac{2\pi}{\lambda} \quad \therefore \lambda = \frac{2\pi}{\beta}$$

$$\beta = \omega\sqrt{LC}$$

$=$ ✓

$\lambda =$ ✓